1971-72 Tuna Survey
West Coast
South Island

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By P. E. Roberts

Fisheries Research Division
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Introduction

A series of trolling cruises was carried out by the fisheries technology vessel *W. J. Scott* from December 1971 to July 1972 along the west coast of the South Island, New Zealand. This report gives details of the vessel's cruise tracks and the location of fish catches, with an analysis of the relationship between the catches and sea surface temperature and the variation of catch rate with time of day.

The object of the cruises was to obtain information on the distribution and abundance of tuna and so determine the potential for a commercial tuna fishery along the South Island west coast.

Before 1970 information on tuna in the area was limited to brief investigations by commercial and sports fishermen working mainly in or near the Fiordland sounds. There were numerous sightings of large pelagic fish during spring and summer, and the few fish caught were either southern bluefin (*Thunnus maccoyi*) or albacore (*T. alalunga*) tuna. From January to March 1970 a more extensive survey was carried out by a Japanese pole and live-bait vessel under charter to a New Zealand company. During this survey albacore were found out to 300 km off shore along much of the South Island west coast, with greatest abundance near Kahurangi Point, towards the north. Small numbers of skipjack (*Katsuwonus pelamis*) and southern bluefin were also caught*.

The surveys carried out from *W. J. Scott* during 1972 confirmed the observations made during 1970 that albacore tuna were present along much of the South Island west coast. They were found from January until May and were more abundant between Cape Foulwind and Jackson Head than elsewhere. The fish caught were mainly of one size group, 56–65 cm fork length, and size composition varied little from north to south.

**See* Webb, B. F. 1972: Report on the investigation of the *Lloret Lopez II* 8 January to 2 April 1970. Section 6: Tuna catch analysis and sea water temperatures. *Fisheries Technical Report, N.Z. Ministry of Agriculture and Fisheries, No. 108.* 105 pp.

Materials and Methods

Between December 1971 and July 1972 eight cruises were made to the west coast of the South Island. The first and last cruises (S18/71 and S9/72) were straight runs along the coast to collect sea surface temperature information, and few hours were spent trolling. The remaining six cruises (S1/72 to S6/72) were primarily trolling surveys and were of 6 to 12 days' duration. Because the whole survey area (about 600 × 80 km) could not be covered adequately during each cruise, the searching pattern usually consisted of either straight line runs along the coast or straight lines with occasional off-shore legs (figs. 1 to 4).

W. J. Scott, a 170-t, 28-m stern-trawler, was modified for trolling by the addition of two 7.5-m outriggers. Between 3 and 10 lines were trolled at 4 to 7 knots either along a set course, which was not altered if a strike was made, or by circling over schools (intensive trolling). Catch rate is defined as the number of fish caught per 100 hook-hours.

Fork lengths were measured during four cruises in January, March, April, and May 1972 to the centimetre below the actual length. Fish were weighed only during fine weather on two cruises in March and May 1972. Whole fish were weighed on a spring balance to the nearest 0.23 kg (0.5 lb).

Sea surface temperature was measured with an electronic probe in the engine water intake pipe, about 2 m below the sea surface. Records were made at 30-min or 60-min intervals from a dial recorder on the bridge. The thermometer was checked against a laboratory-calibrated mercury thermometer, and readings were found to have an accuracy of ± 0.3°C. During March 1972 supplementary sea surface temperature information was obtained by use of an infra-red radiometer carried in a Piper Aztec aircraft.

**See* Roberts, P. E. 1971: Sea surface isotherm maps for tuna fishermen. *Fisheries Research Division Information Leaflet, N.Z. Marine Department, No. 2.* 9 pp.

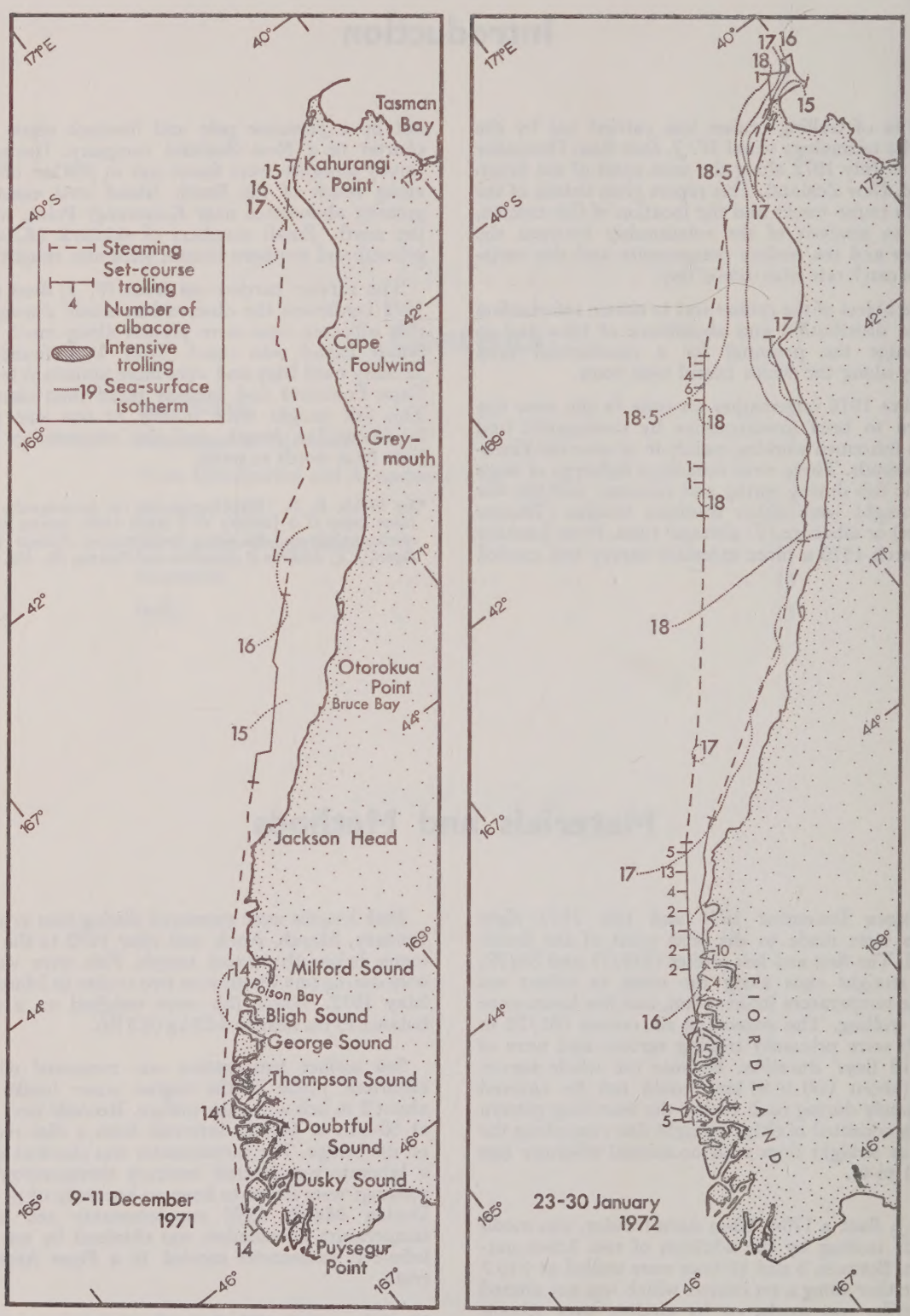


Fig. 1: Cruise tracks, albacore catch locations by hourly periods, and sea surface temperature isotherms (°c) off the west coast, South Island, December 1971 and January 1972.

Fig. 2: Cruise tracks, albacore catch locations by hourly periods, and sea surface temperature isotherms (°c) off the west coast, South Island, February 1972.

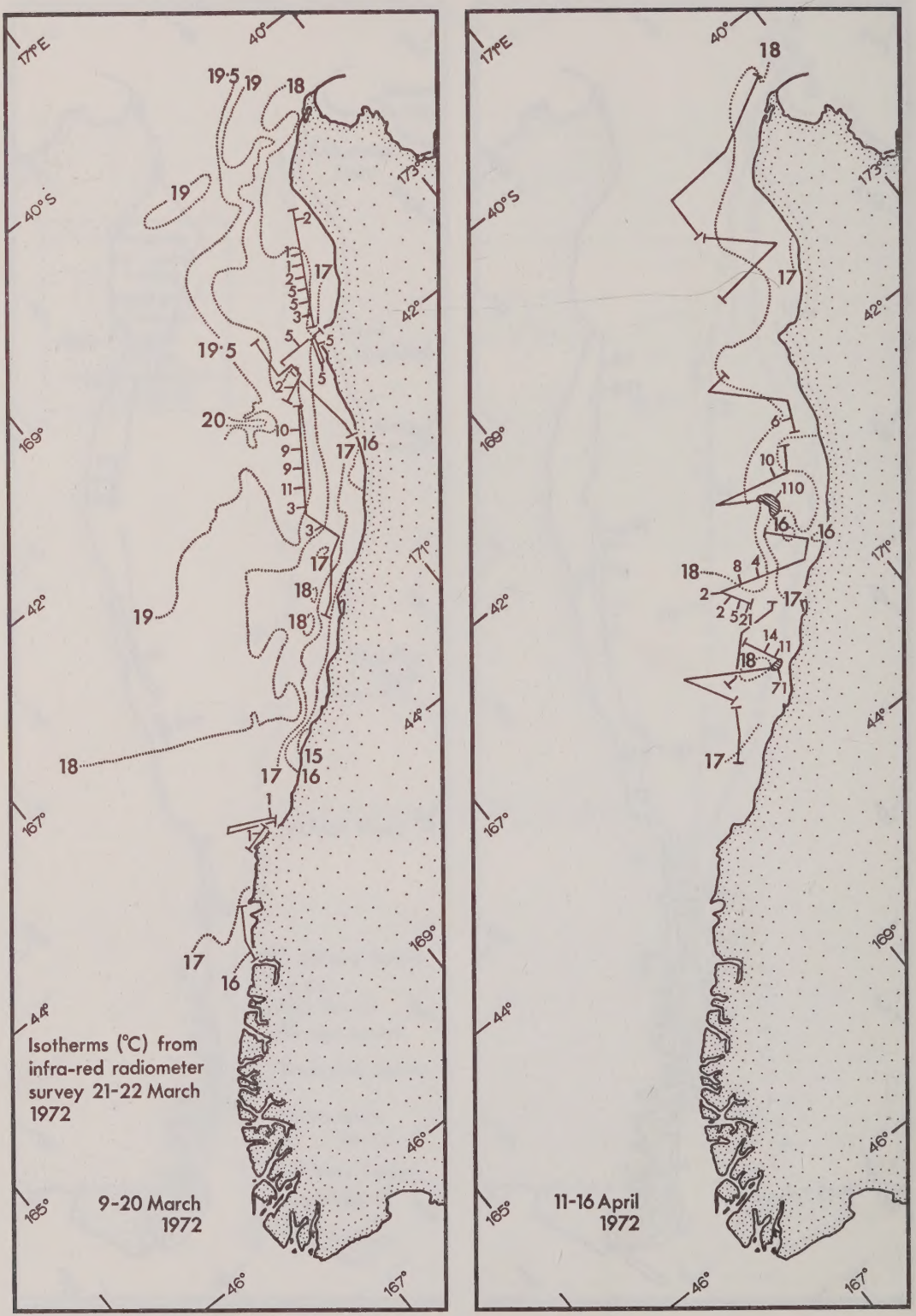


Fig. 3: Cruise tracks, albacore catch locations by hourly periods, and sea surface temperature isotherms (°c) off the west coast, South Island, March and April 1972.

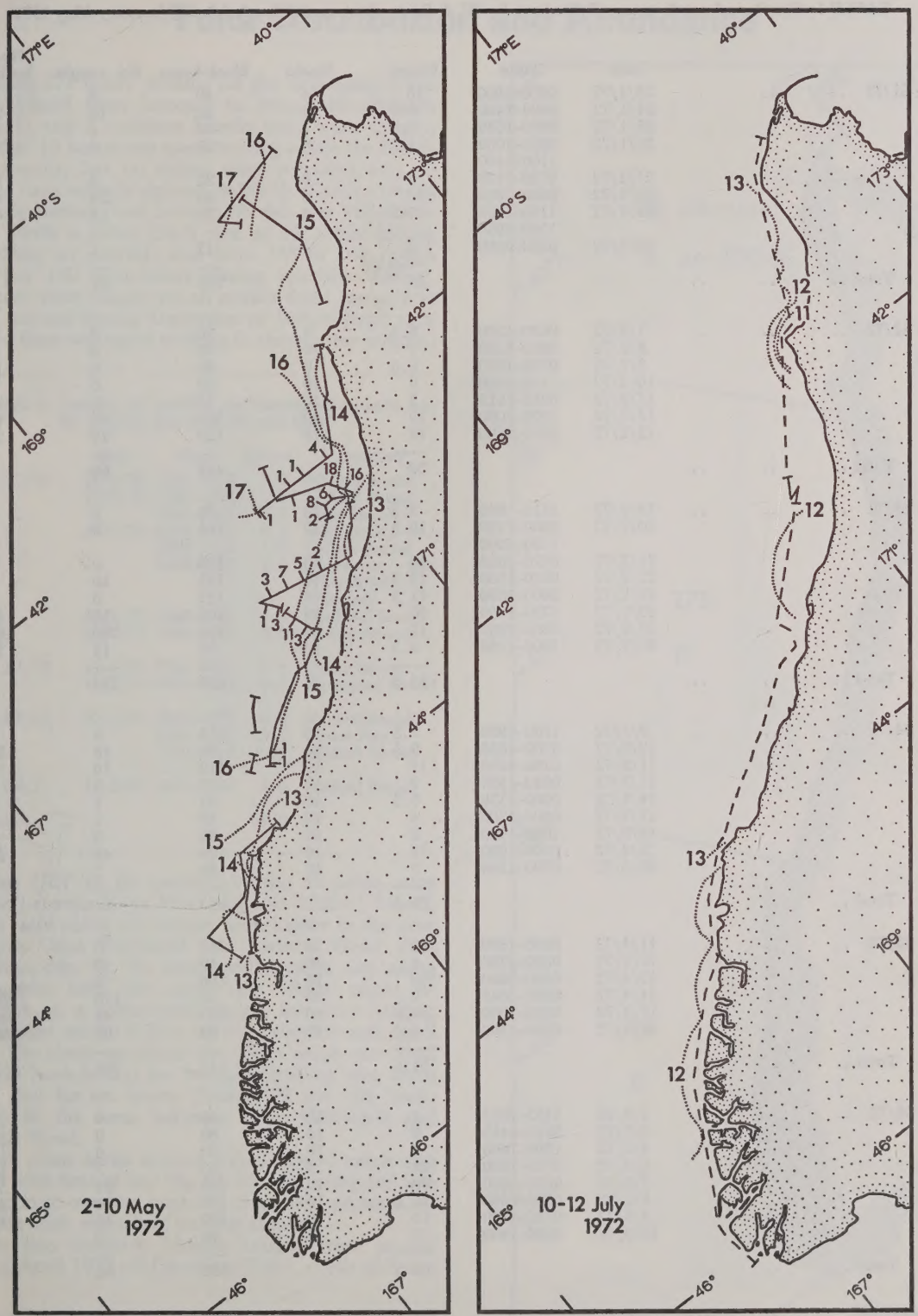


Fig. 4: Cruise tracks, albacore catch locations by hourly periods, and sea surface temperature isotherms (°c) off the west coast, South Island, May and July 1972.

TABLE 1: Catch and catch rates of albacore by *W. J. Scott*, west coast, South Island, January-May 1972

	Date	Time	Hours	Hooks	Hook-hours	No. caught	No./100 hook-hours
Cruise S1/72	23/1/72	0800–1800	10	4	40	0	0
	24/1/72	0800–1430	6.5	4	26	10	38
	25/1/72	0900–1630	7.5	4	30	4	13
	26/1/72	0830–1000	4.5	6	27	0	0
		1100–1400					
	27/1/72	0730–1130	4	8	32	9	28
	28/1/72	0600–1800	12	4	48	29	60
	29/1/72	1100–1400	7.5	4	30	14	47
		1500–1930					
	30/1/72	0500–0800	3	4	12	1	8
Total			55		245	67	
Cruise S2/72	7/2/72	0630–1300	6.5	4	26	0	0
	8/2/72	0800–1500	7	10	70	0	0
	9/2/72	0730–1600	8.5	10	85	0	0
	10/2/72	1100–1600	5	10	50	0	0
	11/2/72	0915–1015	1	10	10	0	0
	12/2/72	1000–2000	10	10	100	40	40
	13/2/72	0800–2000	12	10	120	29	24
Total			50		461	69	
Cruise S3/72	19/2/72	1615–1945	3.5	10	35	0	0
	20/2/72	0600–1400	10.5	10	105	0	0
		1730–2000					
	21/2/72	0620–2020	14	10	140	0	0
	22/2/72	0620–1950	13.5	10	135	10	7
	23/2/72	0600–1830	12.5	10	125	0	0
	28/2/72	0730–1730	10	10	100	10	10
	29/2/72	0800–2000	12	10	120	200	167*
	30/2/72	1000–1930	9.5	10	95	14	15
Total			85.5		855	234	
Cruise S4/72	9/3/72	1200–1930	7.5	10	75	0	0
	10/3/72	0700–1630	9.5	10	95	18	19
	11/3/72	0730–1830	11	10	110	10	9
	12/3/72	0630–1330	7	10	70	5	7
	14/3/72	0900–1530	6.5	10	65	1	2
	15/3/72	0800–1200	4	10	40	1	3
	18/3/72	1630–1930	3	10	30	0	0
	19/3/72	0700–1900	12	10	120	44	37
	20/3/72	0700–1200	5	10	50	2	4
Total			65.5		655	81	
Cruise S5/72	11/4/72	0630–1830	12	10	120	0	0
	12/4/72	0800–1200	4	10	40	0	0
	13/4/72	0800–1800	10	10	100	6	6
	14/4/72	0945–1845	9	10	90	120	133*
	15/4/72	0830–1900	10.5	10	105	42	40
	16/4/72	0700–1300	6	10	60	96	160*
Total			51.5		515	264	
Cruise S6/72	2/5/72	1415–1815	4	10	40	0	0
	3/5/72	0615–1415	8	10	80	0	0
	4/5/72	1300–1600	3	10	30	0	0
	6/5/72	0700–1900	12	5	60	7	12
	7/5/72	0800–1800	10	10	100	51	51
	8/5/72	0730–1800	10.5	10	105	21	20
	9/5/72	0730–1730	10	10	100	16	16
	10/5/72	0800–1400	6	3	18	0	0
Total			63.5		533	95	
All cruises 1972			371		3,264	810	

*Intensive trolling in one area.

Tuna Distribution and Abundance

During 371 hours' trolling off the west coast of the South Island from January to May, 810 albacore (table 1) and 2 southern bluefin tuna were caught. A further 14 hours was spent trolling inside the Fiordland sounds, but no strikes were recorded and no surface tuna schools sighted (table 2). Catch rate for albacore varied from zero to 60 fish per 100 hook-hours (with a mean catch rate of 14) while fishing was along set courses; and from 133 to 167 (mean 142) per 100 hook-hours during intensive fishing. Albacore were caught on all cruises from January to May, but not during December or July, though very limited time was spent trolling in these latter months.

TABLE 2: Details of trolling in Fiordland sounds by *W. J. Scott*, January-March 1972

	Date	Time	Hours	Location
Cruise S1/72 ..	24/1/72	1520–1620	1.0	Milford Sound
	25/1/72	0800–0900	1.0	Milford Sound
		1600–1630	0.5	Bligh Sound
	26/1/72	0650–0720	0.5	Bligh Sound
		1000–1100	1.0	George Sound
		1400–1700	3.0	Thompson and Doubtful Sounds
	27/1/72	1540–1640	1.0	Doubtful Sound
	28/1/72	1000–1030	0.5	George Sound
S2/72 ..	11/2/72	0745–0915	1.5	Dusky Sound
	12/2/72	0920–0950	0.5	Thompson Sound
S3/72 ..	27/2/72	0900–0930	0.5	Milford Sound
		1100–1130	0.5	Poison Bay
		1240–1310	0.5	Milford Sound
S4/72 ..	16/3/72	1000–1200	2.0	Milford Sound
Total ..			14.0	

Most (727 or 89 percent) of the albacore were caught between Cape Foulwind and Milford Sound. Catch rates along set courses were higher in the area between Cape Foulwind and Jackson Head than elsewhere (fig. 5). To compare the catch rate along set courses with the catch rate which might be expected on a commercial vessel, intensive trolling was carried out on 3 days during February and April 1972. On these occasions the mean catch rate (142 per 100 hook-hours) for intensive trolling was seven times that for set course fishing (22 per 100 hook-hours) in the area between Cape Foulwind and Jackson Head.

As in other areas around New Zealand catch rate varied with time of day (fig. 6). Mid-morning and late afternoon to evening peaks in catch rate presumably coincide with periods of feeding activity.

The two southern bluefin caught were landed during April 1972 off Otorokua Point, north of Bruce

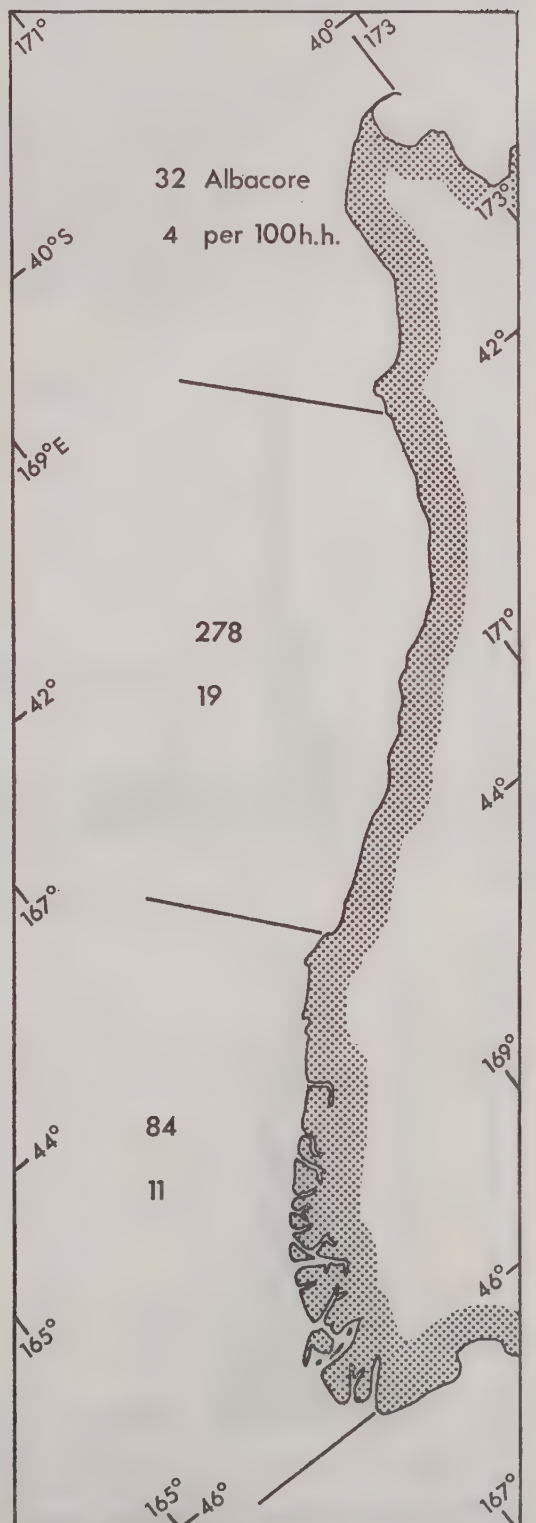
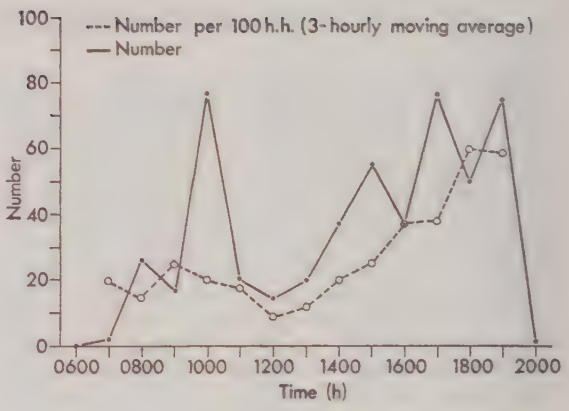


Fig. 5: Summary of albacore catch rate data from set-course trolling off the west coast, South Island, January to May 1972.

Fig. 6: Variation with time of day of catch and catch rate of albacore caught off the west coast, South Island, during January, March, April, and May 1972. Catch rate is given as the moving average of successive 3-hourly periods to smooth wide fluctuations of data.



Bay. In January 1972 several lines were lost during fishing off Doubtful Sound. The strikes then were probably large southern bluefin tuna, as the lines broke very easily. On the same day several large albacore (70–84 cm in fork length) weighing up to 12 kg were landed without difficulty. Again, during March 1972, two lines were lost off Jackson Head, presumably to large southern bluefin tuna.

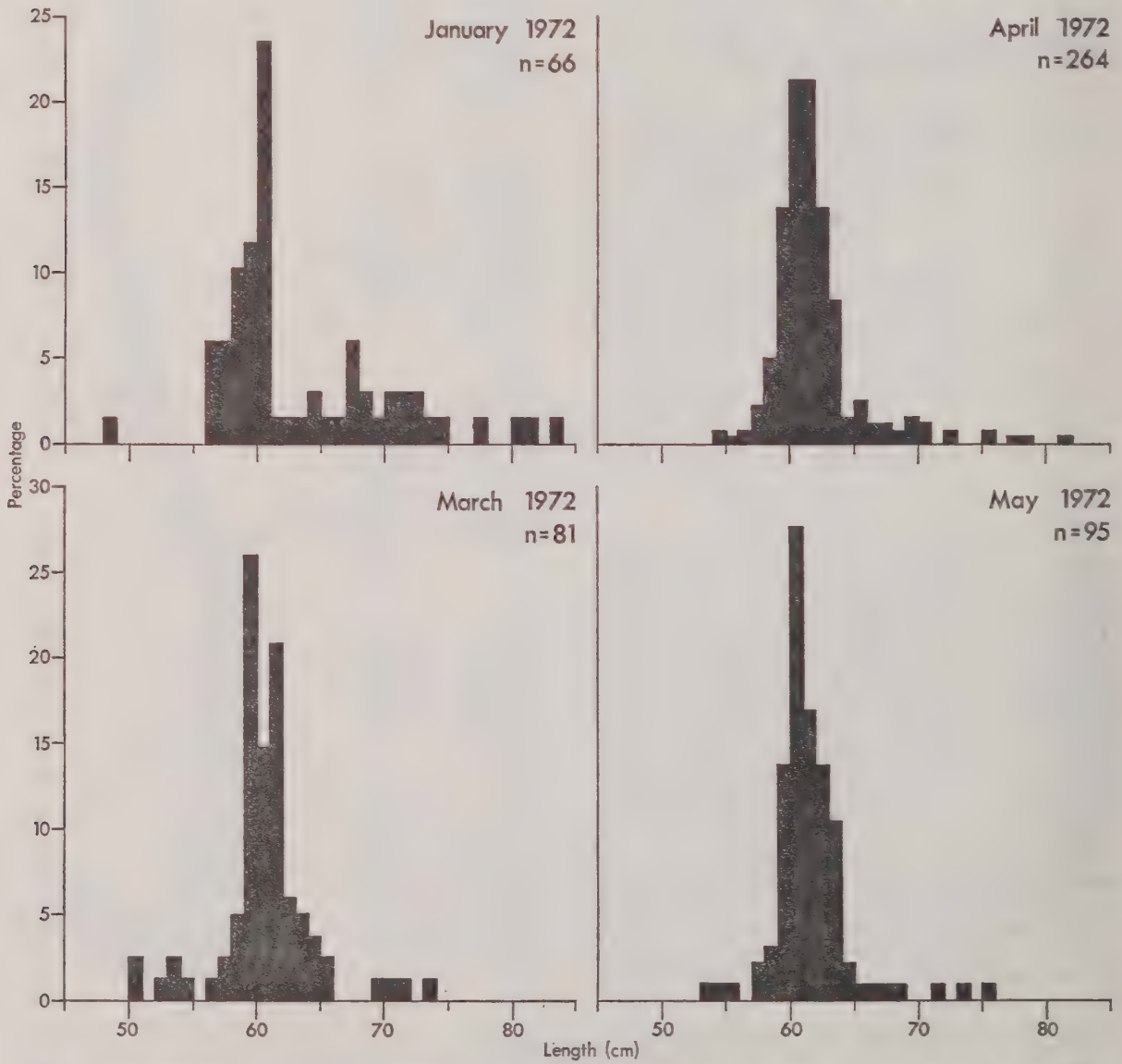


Fig. 7: Length-frequency distributions of albacore caught off the west coast, South Island, during January, March, April, and May 1972.

Albacore Size

Albacore caught during cruises in January, March, April, and May 1972 were 48–84 cm in fork length (fig. 7). The catch was dominated by one size group, 56–65 cm long. This group was composed of 3-year-old fish and made up 87 percent of the total catch by number. There was little variation in the size composition with time or area, though during January it was noted that there was a greater proportion of larger fish (65–84 cm) in catches made south of Milford Sound compared with catches further north. There was no shift in the modal peak of the 3-year-old albacore from January to May, which suggests that there was no pronounced increase in length during this period.

The albacore ranged from 2.72 kg (6 lb) for a 50-cm fish to 9.07 kg (20 lb) for a 75-cm fish. Three-year-old albacore were 4.08–6.13 kg (9–13.5 lb), with a mean weight of 5 kg (11 lb).

Sea Surface Temperatures

Sea surface temperatures ranged from 11° to 20°c in the area surveyed (figs 1 to 4).

Trolling was done in areas where sea surface temperatures were 13° to 19.5°c. Albacore were caught only where sea surface temperatures were 14° to 19.5°c, and 90 percent of the catch was made between 15° and 18.5°c (fig. 8). Catches were generally made just outside the boundary between cool in-shore water and warm off-shore water.

Lowest sea temperatures were recorded off Fiordland in July and the highest temperatures off Cape Foulwind in March. Monthly mean sea surface temperatures at or near the edge of the continental shelf (bottom depth 180–200 m) for five areas along the coast are plotted in fig. 9. (On cruises where the vessel did not pass over the shelf edge, near-shore data were used.) After rapid warming from December to January temperatures stabilised until March or April before dropping to the July minima. In all areas highest temperatures were recorded in February or March.

Sea surface temperature decreased from north to south. There was a 3° to 5°c north-south difference in summer and a 1° to 2°c difference in winter. On the continental shelf isotherms ran parallel to the coastline, with cold, discoloured river (or fiord) run-off in shore and warmer oceanic water off shore. Temperature fronts of up to 3°c were recorded along this boundary, which was often marked as a line between green and blue water. Further off-shore isotherms tended to run parallel to lines of latitude.

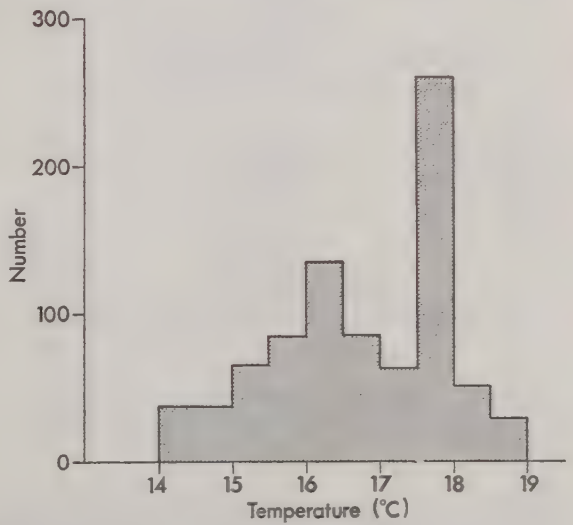


Fig. 8: Variation with sea surface temperature of catch of albacore off the west coast, South Island, January to May 1972.

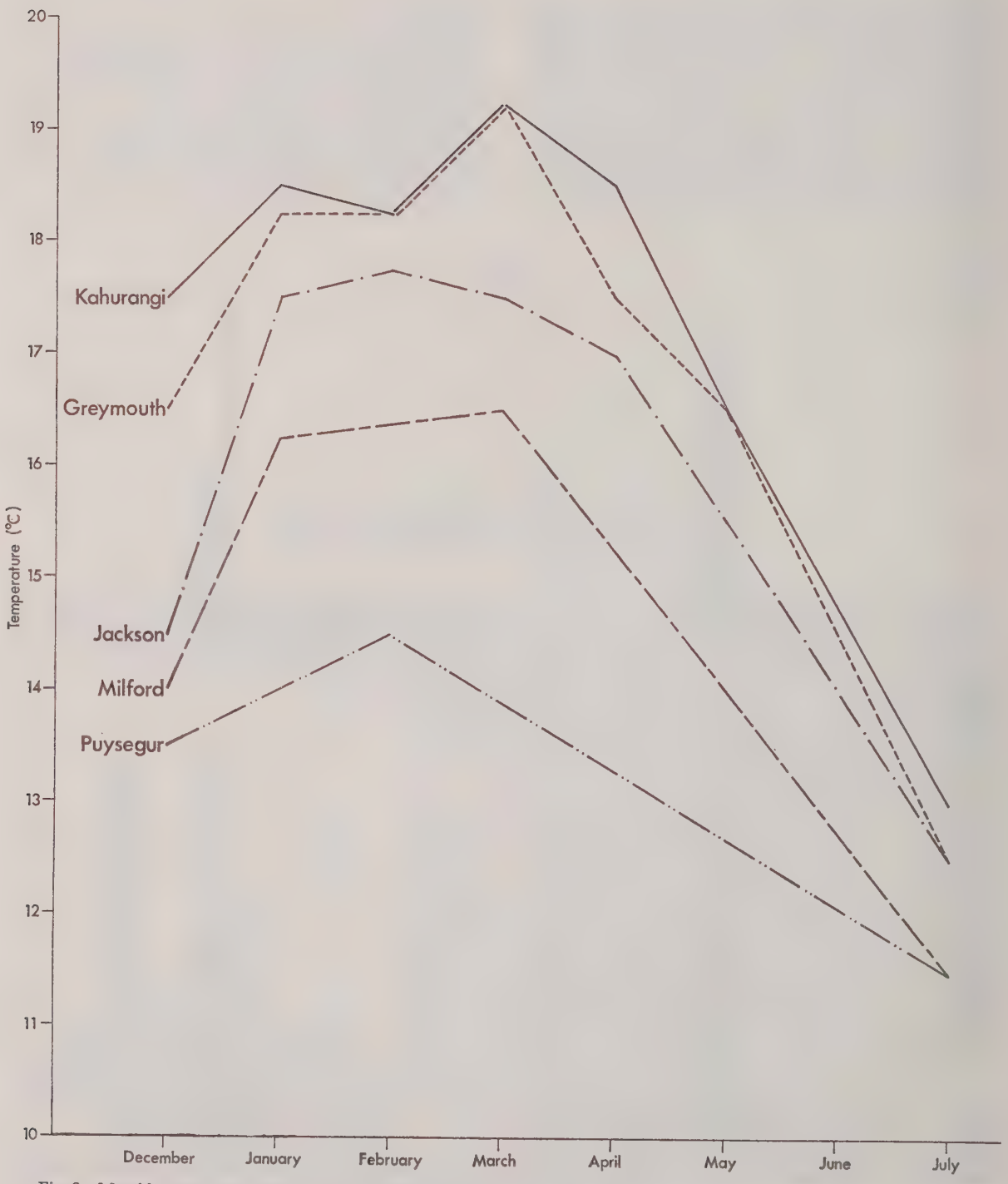


Fig. 9: Monthly mean sea surface temperatures (°c) near the edge of the continental shelf at five areas along the west coast, South Island, December 1971 to July 1972.

Discussion

The size composition of albacore caught during 1972 was quite different from that of 1970 as reported from data collected on the Japanese pole and live-bait vessel *Lloret Lopez II*. During 1970 albacore caught west of Kahurangi Point were predominantly 2- (33 percent of the catch) and 3- (60 percent) year-old fish. South of Cape Foulwind albacore were less abundant, and the catch consisted of 3- (35 percent) and 4- (60 percent) year-old albacore. This contrasts with the 1972 catch, of which 87 percent were 3-year-old albacore throughout the area. Further north, off the west coast of the North Island, the 1972 albacore catch consisted mainly of 2- (20 percent) and 3- (78 percent) year-old albacore, which is similar to catches off Kahurangi Point in 1970 (fig. 10).

Sea surface temperatures were 1° to 1.5°c higher during March 1970 compared with those in March 1972 (fig. 11). In years where sea surface temperatures are higher (for example, 1970) small albacore (that is, 2-year-old fish) may therefore migrate further south and reach the west coast of the South Island.

The reason for the absence of 4-year-old fish during the 1972 season is not clear. A few large fish were caught south of Milford Sound in January 1972, but there were generally few fish caught off Fiordland. However, these large albacore could have been present outside areas searched by *W. J. Scott.*

On *Lloret Lopez II* albacore from south of Cape Foulwind were mainly caught between 40 and 300 km from shore and it was found that fish size increased with distance from land. Albacore caught between 80 and 300 km off shore in March 1970 were predominantly 4-year-old fish. Further investigation of these off-shore waters for surface albacore schools is warranted.

During 1972 few albacore were caught off Kahurangi Point, where they were abundant in 1970. This shift in the distribution of schools was to some extent reflected off the west coast of the North Island. During summer 1970 and summer 1971 albacore were abundant near New Plymouth, but in 1972 the schools were concentrated 100 to 150 km north of New Plymouth. Seasonal variation in albacore distribution is probably related to variation in sea temperature, the distribution of suitable food organisms, and prevailing surface currents.

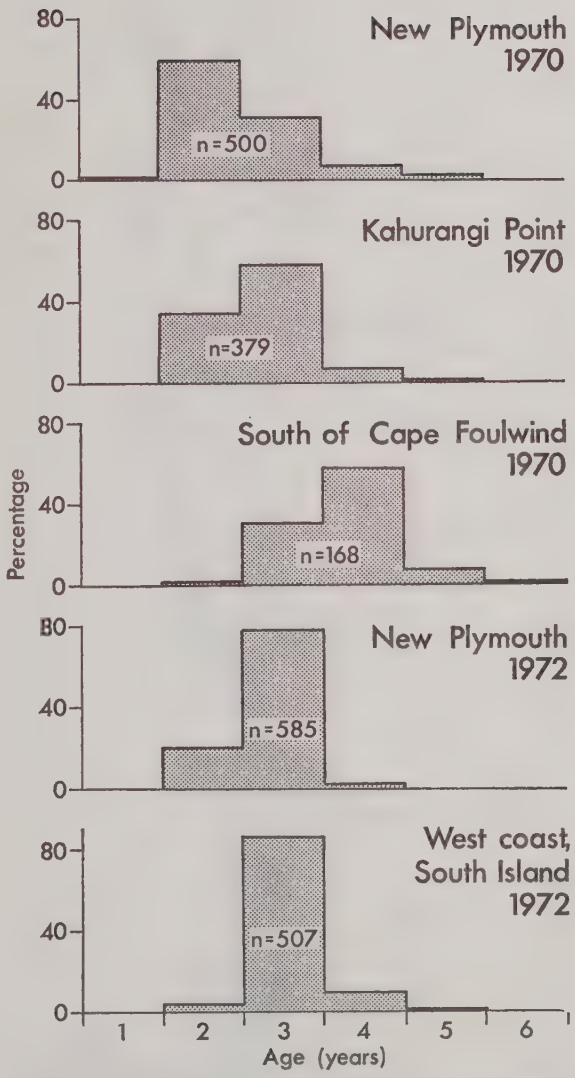


Fig. 10: Age-frequency distributions of albacore caught off the west coast of New Zealand during 1970 and 1972.

Further study of the importance of these different factors will be needed before it will be possible to predict areas where schools of albacore are likely to occur.

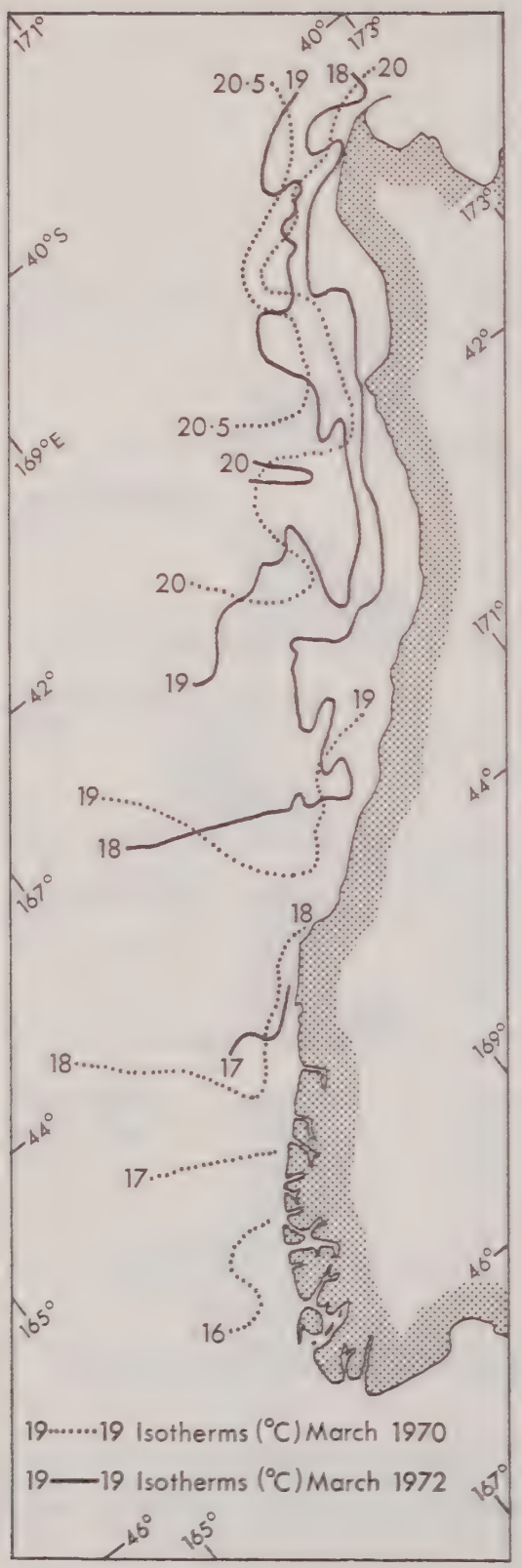


Fig. 11: Sea surface temperature isotherms (°c) off the west coast, South Island, during March 1970 and March 1972.

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